Yield stability analysis for three winter wheat composite cross populations under organic and conventional management over five years.

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Increasingly uncertain climatic conditions threaten the security and stability of agricultural systems (Østergård *et al*., 2009; Döring *et al*., 2011) and a better understanding of genotype x environment (GxE) interactions is needed to shift the agricultural focus from manipulating environments to grow crops to creating crops that fit into the environment (Østergård *et al*., 2009; Lammerts van Bueren *et al*., 2012). GxE interactions play a pivotal role in assessing yield stability of crops and the challenge of changing climatic conditions necessitates that new crop cultivars should have broad adaptability, stable agronomic performance over a range of environments and management systems and generally high yields (Akcura *et al*., 2006). The High genetic Diversity (Hi-D) approach is relevant to organic and low-input agricultural systems due to the comparatively large environmental variability found in these systems, where increased genetic diversity is better able to cope with higher biotic and abiotic stresses (Annicchiarico and Filippi, 2007; Döring *et al*., 2010; Dawson and Goldringer, 2012). Three winter wheat composite cross populations (CCP) have been grown under both organic and conventional conditions since the F_4 at the research fields of the University of Kassel in Neu Eichenberg, Germany. A number of yield stability indicators were calculated for the three CC populations (YQ, Q and Y) grown under both organic and conventional conditions over five harvest years (2008, 2010, 2012, 2014 and 2015). The reference varieties Achat and Capo were also grown alongside the organic CCPs for comparison. In terms of yield stability on the organic site, the CCP YQ showed the highest stability for three values in the analysis (R^2, MSE and W^2), making it the most stable population in terms of the stability analysis of the populations and varieties under organic management. Low values for CV% and environmental variance (S^2), being the variance of the genotype yields over all environments, indicate that the Q population was the most stable for these two stability measures. The reference varieties Achat and Capo had a general tendency towards less stability than the organic CC populations, only for the value of S^2 did Capo show some stability in terms of environmental variance over the organic CC populations YQ and Y. The conventional populations did not show many of the same tendencies in terms of population stability as found in the organic system. The conventional Y population had a slope of 1.24 and a R^2 value of 0.99. This population also had the lowest MSE of all the populations (0.007), indicating a higher degree of stability for these measures. The gradient of the slope was much steeper in comparison to the organic Y population, which had a slope closer to 1, indicating that under conventional management, the Y population was able to react more strongly under favourable condition. The conventional YQ population had the highest mean yield over the five years and the lowest value for W^2, indicating the greatest stability in terms of GxE interactions. In comparison, the organic YQ population had a higher degree of stability with the best values for more stability measures, indicating that perhaps under less favourable conditions, the organic YQ population is more stable and able to adapt to challenging conditions. The CCP Q population under both organic and conventional management showed a high degree of yield stability, indicating that this population, although not the highest yielding, may be the best suited for a wider range of conditions.

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